PROGRESS OF ELECTRIC SCIENCE

Third of a Series of Popular Articles by C. J. Kintner, Examiner Class Electricity, United States Patent Office.

The late Prof. Clerk Maxwell, of England, defines electric induction to be a strain of some kind and light to be a similar strain, each acting through the medium of ether in space.

So closely allied are these two phenomena that he was led to make an extended series of experiments to prove their actual identity, and had he lived no doubt he would have succeeded. Indeed, he did prove mathematically that both magnetic and electric disturbances act at right angles to lines of force, just as light vibrations travel with relation to a ray of light.

He and others also proved that induced electricity travels through space at the rate of 192,000 miles per second—the accepted velocity of light according to the known proofs—thus establishing an additional relation.

Following closely upon the experiments of Prof. Maxwell, others discovered that selenium—an elementary substance closely related to sulphur, and found in nature in the Hartz mountains of Germany—had peculiar electrical properties when acted upon by light.

Messrs. Adams and Day, members of the Royal Society, made an extended series of experiments with selenium to ascertain the peculiar relations found to exist between light and electricity. They discovered that upon connecting a stick or bar of selennium directly in an electrical circuit containing a galvanometer or electrical indicating instrument, and then causing a light to be thrown upon the selenium, the galvanometer indicated a change of strength of current dependent upon the square root of the illuminating power. Speculating upon the wonderful effect thus produced by light upon an electric current they were led to make an experiment to ascertain if it were possible to generate electricity by simply throwing light upon the selenium cell, when connected in a circuit with a delicate galvanometer or indicator of electricity, and without any prime generator in the circuit. To their astonishment and delight the delicate little instrument indicated the presence of electricity. Here, then, was a case of transformation of light directly into electricity, a most wonderful discovery.

With that persistence with which the ever curious scientist seeks the reason for unexplained phenomena, they labored unceasingly for weeks and months to ascertain if this were a case of transformation of one kind of energy into another, or if it were an actual proof of the identity of electricity and light. They discerned that selenium in hardening, after having been fused, assumes a crystalline condition dependent upon the rapidity with which it cools, the outer surface cooling the more rapidly. Hence the whole cell, when ultimately cooled, is in such a varied state of crystallization that the passage of light through it tends to further promote crystallization in the inner parts of the cell, and it is this exercise of the radiant energy of light which sets up a current, by creating a change of electrical potential or pressure between the outer and the inner portions of the cell.

Light in its passage through certain transparent bodies is known to very materially aid in their crystallization and its passage through the selenium cell tends to create a current running from the outside to the inside of the cell. That this is the action was effectually proven by casting a selenium cell and by allowing it to cool gradually under exposure to the light, so that its crystalline condition was identical throughout. From such a cell not the slightest trace of a current was detected upon submitting it to the above tests.

Little or no use has been made of these interesting discoveries in the art, the first practical application being Prof. A. Graham Bell's radiaphone for transmitting speech through space by the agency of reflected light, of which we shall have occasion to speak in a future paper on the subject of telephony. There have been a few applications of this principle to the regulation of dynamo machines and to the feed of arc lamps and other regulators, but with what success we are unable to assert.

Whether electricity can be generated in paying quantities from the sun's light remains a mystery to be solved by the ingenuity of the untiring inventor. It is a field well worthy of careful study, and, like thermal generation, has in it many possibilities.

It is not an improbable or mythical prophecy to assert that the sun gives us daily by light and heat a source which will some day, not far distant, be utilized to generate electricity sufficient to supply our demands in heat, light, and power.

We look for more in the near future in the direction of the generation of electricity for light and heat than has been done in the past by the direct application of power, and its conversion into electricity by intervening mechanism.

Passing now to frictional electricity, it is curious to note that this was the first kind of electricity known, or perhaps we might better say it was by friction that electricity was first generated, and once for all disabuse the reader's mind of any idea that there is more than one kind of electricity which may be generated in many ways, thus conceiving, if we may so express ourselves, that electricity exists in the nature of an imponderable agent which to be appreciated or detected needs only to be set in motion, and the different modes of setting it in motion we are now discussing.

If we take a simple rod of glass and rub it violently with a silk handkerchief, and then present the rubbed end of the rod to small light particles of paper, it will attract them, thus exhibiting the presence of electricity. If we attempt the same thing with a rod of iron or brass no electrical effect is noticed. This is not because no electricity is generated by rubbing the rod of iron or brass held directly in the hand, for electricity is produced, but is carried directly to the earth. If the rod is insulated by a glass or gutta percha handle we will observe electrical effects. This difference is due to the fact that all bodies are divided into two classes, electrically known as conductors and non-conductors, or those which transmit electricity from point to point, and those which hold it in a bound or charged condition. There is no fixed line of division between the two in nature, inasmuch as one class merges into the other, a good conductor being a bad insulator, and vice versa.

The frictional generator, then, is a machine which separates or stores up electricity by or through the agency of friction.

The electrophorous is the simplest form, and consists of two parts; first, a metal disc of some non-conducting material, as rosin, shellac, or gutta percha, and second, a brass or metal plate similar to the non-conducting disc, and having a glass or insulating handle.

To generate a current of electricity with this simple device, take the brass plate by its insulating handle and rub it briskly with catskin or a fur muff, then place it upon the insulated disc for an instant, now lift it up by its handle, and if touched by the finger it will be found to be charged, and will give off at the point touched a sharp spark.

The modern friction generator for laboratory use is based upon this simple idea of setting electricity in motion by simple friction between dissimilar bodies just as heat is generated by rubbing together analogous bodies.

The friction machine found in every laboratory consists simply of large glass plates or circuits from two to three feet in diameter, and having rubber or insulated armatures for generating the current by frictional contact, the current being taken off by sharp-pointed devices located near the opposite side of the revolving plates. This generator will probably never be improved upon so as to make it economical in the generation of electricity, and we prophesy that generations hence will see it no further advanced than it is today.

It is useful only in that it generates currents of very high tension or pressure and little quantity, the most powerful machine giving less quantity than a simple galvanic cell.

The electricity generated is identical in its peculiarities with that found in the nature of lightning, being of high tension and small quality, and it is a very interesting scientific fact that during the use of a large friction generator we detect ozone, a gas often detected in the atmosphere by its peculiar odor directly after a violent thunderstorm.

There has been almost no improvement in friction generators within twenty years; indeed, there is little or no room for it, for the possibilities in this direction are few, and it is lost time to make the attempt.

There have been granted to date upon friction generators less than twenty patents, and the office does not receive upon an average one application per year upon this class of inventions.

Our next article will be devoted to magneto and dynamo generators, and will appear two weeks from to-day.

A SILVER SUNRISE.

The Splendid and Peculiar Pageant of Morning in Southwestern Georgia.

Poets have sung of rosy dawns, of orange sunsets waning low, and of that later hour when large Hesper glitters through the rosy spaces, while mid silent spheres rises the deepening night. But the poet is yet to be who will tell in numbers worthy of the theme the story of that magical drama of nature, the silver sunrise in the south, or in that part of it known as the cotton belt of southwestern Georgia. There the isotherm is semi-tropical. The almost flat, slightly undulating landscape is, or was twenty years ago, under the high cultivation of the slave system, a sheet of verdure breathing incense in the months of March, April, and May. The tall cypress, the thick-leaved ambrosial live oak, the heavy-scented magnolia grandiflora, form the upper foliage, belting the clear dark ponds that dot the low, flat, level tracts. Around their sedgy borders the cranes and curlews call, on their dark bosoms swim the broods of mallard and teal ducks. All the beauty and picturesque charm of nature do not belong to mountain lands alone. To the lover of nature in all her phases and moods, this pond land is as full of beauty as of bloom. It is lively all seasons of the year, all hours of the day, but especially when seen under a silver sunrise.

Not every morning of the whole year round is this wonder witnessed. It takes peculiar conditions of the atmosphere to produce the phenomenon. To the savant belongs the task of telling what the conditions are that produce a silver sunrise. The effect I will try to describe. In April or May the early spring rains that have soaked the porous soil, and filled the ponds, and given the flush and lusty green hues to the earth, have ceased to fall, when the atmosphere is rarified by a heat that makes the young cotton plants grow visibly under your eye; in the darkness of a morning that is only slightly cooler than the night in which you have watched the motions of the constellations in the cloudless heavens, you may rise, as I have risen, morning after morning, to catch that fleeting first scene in the first act of the spectacular drama of a sunny day in the sunny south.

Do not wait to hear the clock strike, or look at your watch, but when dawn is near, the swift-passing dawn of that latitude, which you will know by the low murmur of insect and bird life around you, rise and hasten forth. You can see the white sands under your feet, but barely not the long, gray mosses that hang like stalactites from the branches of the trees above your head only faintly in the gloom made visible by starlight and the swift-moving dawn. In that latitude twilight and dawn are matters of only a few minutes. The stars blaze out, as it were, in the beams of the rising sun. In the negro parlance of the old times: "It is broad day before you know what you are about." The sedgy rims of the ponds, the tall cypresses and oaks, the heavy trailing creepers of the vines, the light swaying banners of the moss, every tiny blade of grass and leaf of plant and weed, every flower petal and wheel of field cobweb is gemmed with beads of dew, but it does not drip. It looks almost like hoarfrost spread over the ocean-like expanse of land and water, like a white veil blending and making more beautiful the darker verdure of the foliage around the pools, and the glowing emerald and color shades of the cotton and corn fields.

A thousand mocking birds are all of a sudden cleaving the blue vault above you with such strains of unpremeditated art as skylark never dreamed of. In fact, if one of the southern mocking birds ever hears the song of one of those English skylarks which the late Isaac W. England found a home for in the meadows of New Jersey, he will beat him so badly in his own song that the British warbler will hide his head under his wing, poor thing, and die of grief and shame.

Afar off from thicket and leafy covert comes the cooing of a thousand doves, the soft whistle of as many quails, the shrill cries of the redbirds, the shriller calls of the catbirds, and the notes of many another feathered songster, whose names you must learn from Mr. Audubon. The thrushes, too, hardly less musical than the mocking birds, sing from the leafy boughs and shrubbery nearer by.

While bathed, as it were, in this outburst of liquid melody, this first diapason of the opera of the day, suddenly, without warning, with no rosy glow to herald his coming, up from the white misty horizon bursts the sun, a blaze of silver light bigger than the biggest cart wheel that ever was made, dazzling, as if composed of ten thousand burnished silver mirrors flashing electric light through panes of crystal, flooding the landscape with silver lace dotted with diamonds and powdered with sparkling silver dust. The sense of the exquisite coloring of the scene is lost in the wondrous radiance shed over a landscape that stretches miles away, until the dazzling view is lost in the silvery haze of the horizon. It looks as if all fairy land had met to battle on a field of jeweled silver, panoplied in silver mail, and every shield and every spear decked and tipped with gems. Not one moment is there rest in this wondrous scene, which lasts but a few minutes, for the first breeze of morning waving the sparkling banners of long moss, and the first warm kiss of the sunbeams sweep the glittering pageant all away.

B. E. V., in New York Sun.

"The Gallant Old War Horse."

The Democrats at Washington are beginning to discover that Hon. Bill Morrison is a very presumptuous and very disagreeable person. His ability weighs about two ounces, but his pretensions weigh a ton. He is trying to obtain patronage on the grounds that he is the leader of the Democratic party of Illinois. This claim is simply preposterous. Mr. Morrison is in no sense a leader of the Illinois Democracy; when he retired from the senatorial contest at Springfield he abandoned every right and title to leadership. The sword he threw down, the standard he deserted, and the white plume he cast aside were picked up and carried to the battle's front by that gallant old Democratic war-horse, Lambert Tree. The air was sulphurous, the cannons belched ball and flame, and slaughter was on every hand. But naught cared Tree; the sole interest he had at stake was principle. Proudly he bore himself in the encounter, and when he came from the awful struggle, scarred though he was and robbed of his green foliage, he still was the proud, imperious monarch of the Democratic forest. Judge Tree has been baptized in the fire, so to speak, and he alone is the leader of Illinois Democracy. If there is any patronage to be doled out he should have the doling of it. It would be a proper thing for him to scuttle away to Washington and baffle the nefarious schemes of the preposterously pretensious Mr. Bill Morrison.—*Chicago News.*

HIS ONE FIT OF THE BLUES.

"Got the blues, friend Gordon?"

Mr. James A. Gordon, teacher of Gymnastics in the Charlier Institute in Fifty-ninth street, New York—a school which deserves its national reputation—was reclining on a lounge at his home in 115th street, when the writer thus addressed him a few days ago. His right foot and ankle were much swollen and swathed in bandages, while on the other he wore the appropriate stocking and house slipper. He was unable to stand, and could not move the affected part without pain.

"Well," he said, "I have served Her Majesty Queen Victoria in the famous regiment called the Blues, and in the army in India and Australia; I also had a taste of life in putting down the Sepoy rebellion; but this is one of the bluest times I ever experienced."

"What's the matter now?"

"The matter," answered the skillful swordsman, with a slight contortion of the muscles of his face, as he placed the sensitive foot in a more comfortable position, "the matter now is a pungent attack of acute inflammatory rheumatism. In fact it amounts to fine mathematical gout. Never had anything like it before in my life."

"You're lucky," I said, "in having it confined to one foot."

"Don't you make that mistake," said Gordon. "A week or ten days ago the other foot was in the same fix. They were both swollen like the legs of an elephant. My physician treated me internally, but the remedy that cured the foot that is now well was Benson's Capcine Plasters. I tried the plasters as an experiment, on one foot first. Bless your soul, they hadn't been on ten minutes before I felt relief. We kept it up, my wife and I, until the swelling went away and the pain with it. They are just miracles, spread on rubber—those plasters are. And now we're operating on the other foot. It's better already. I've got my foot and part of my leg covered with Benson's plasters, under those bandages. Going? Well, good morning. If you ever have the rheumatism or the gout try my medicine."